

AD-A101 588

HYDRA CORP VIENNA VA
SEA-BASED DEPLOYMENT OF FLOATING-LAUNCH MISSILES. APPENDICES.(U)
DEC 80 J E DRAIM
OTA-133-0830.0

NL

UNCLASSIFIED

TR-102-80-APP

F/G 16/4.2

J of 1
AD-A101 588

END
DATE FILMED
8-81
DTIC

2

ADA101588

TR-102-80 (Appendices)

LEVEL III

SEA-BASED DEPLOYMENT OF
FLOATING-LAUNCH MISSILES

4101587

DTIC
ELECTED
JUL 20 1981

APPENDICES

December 15, 1980

E

Hydra Corp.

9310 TELFER CT.
VIENNA, VA. 22180
(703) 281-4489

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

81 7 20 014

FILE COPY

9 Fiscal Year 1981-12-10-16-1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|--|---|--|
| 1. REPORT NUMBER HYDRA Corp. TR-102-80 (Append.) | 2. GOVT ACCESSION NO. AD-A101 588 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and SUBTITLE) Sea-Based Deployment of Floating-Launch Missiles (Appendices, Information Furnished by J.J. Henry Co., Inc., and Rohr Marine, Inc.) | 5. TYPE OF REPORT & PERIOD COVERED Final Report 11-15-80 to 12-15-80 | |
| 6. AUTHOR(s) John E. Drain | 7. PERFORMING ORG. REPORT NUMBER TR-102-80 (Append.) | |
| 8. CONTRACT OR GRANT NUMBER(s) OTA #133-0830.0 | 9. PERFORMANCE ORGANIZATION NAME AND ADDRESS HYDRA Corporation 9310 Telfer Court Vienna, VA, 22180 | |
| 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS | 11. CONTROLLING OFFICE NAME AND ADDRESS Office of Technology Assessment 600 Pennsylvania Ave., SE Washington, D.C. 20510 | |
| 12. REPORT DATE 15 December, 1980 | 13. NUMBER OF PAGES 37 | |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Q-14-176-4-111 | 15. SECURITY CLASS. (of this report) Unclassified | |
| 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. | | |
| 17. DISTRIBUTION ST. (ENT (of this abstract entered in Block 20, if different from Report)) | | |
| 18. SUPPLEMENTARY TES This study was undertaken in support of an Office of Technology Assessment review of various MX basing options. | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) MX Basing MX Deployment Sea-Based Missiles Floating-Launch Missiles HYDRA Missiles Containership Surface Effect Ship (SES) | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The basic report presents systems concepts descriptions for sea-based MX missiles, using surface ships as transporters. Near-term (1985-1990) and far-term (1990-2000) systems are described. Floating launch methods are proposed, using either encapsulated missiles or the simpler (bare) HYDRA-type vertical floating launch. Parameters described include: force composition, missile jettison techniques, port facilities, deployment areas, personnel requirements, system costs, vulnerability, countermeasures, and C3 considerations. Appendices include containerships and surface effects ships (SES) data. | | |

DD FORM 1 JAN 73 1473

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

413, 1473

APPENDIX A

Information Furnished by:
J.J. Henry Co., Inc.

J.J. HENRY CO. INC.

NAVAL ARCHITECTS · MARINE ENGINEERS · MARINE CONSULTANTS



December 10, 1980

CENTURY BUILDING
2341 JEFFERSON DAVIS HIGHWAY
SUITE 838
ARLINGTON, VIRGINIA 22202
703-920-3435

Mr. John Draim
President, Hydra Corporation
9310 Telefer Ct.
Vienna, Virginia 22180

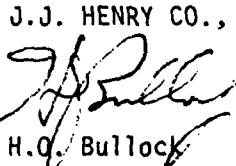
Dear Mr. Draim,

In accordance with your request regarding possible application of the SL-7 high speed containship in a MX role we are pleased to submit enclosure (1) as a quick look response to your specific questions.

If you have any additional questions, or we may be of any additional assistance, please contact me.

Very truly yours,

J.J. HENRY CO., INC.


H.O. Bullock
Manager

| | |
|----------------------|-------------------------------------|
| Accession For | |
| NTIS | GRA&I |
| DTIC TAB | <input checked="" type="checkbox"/> |
| Unannounced | <input type="checkbox"/> |
| Justification | |
| By | |
| Distribution/ | |
| Availability Codes | |
| Avail and/or Dist | Special |
| A | |

Enclosure

MOORESTOWN · NEW YORK · BOSTON · NORFOLK · WASHINGTON, D. C.

The information presented below is in response to your questions concerning the J.J. Henry Co., Inc. designed high speed containership, the SL-7. The questions and the answers are listed below.

1. Question: What are the cost and possible construction schedules at a high priority for a production run of 24 SL-7's or for a production run of 32 SL-7's.

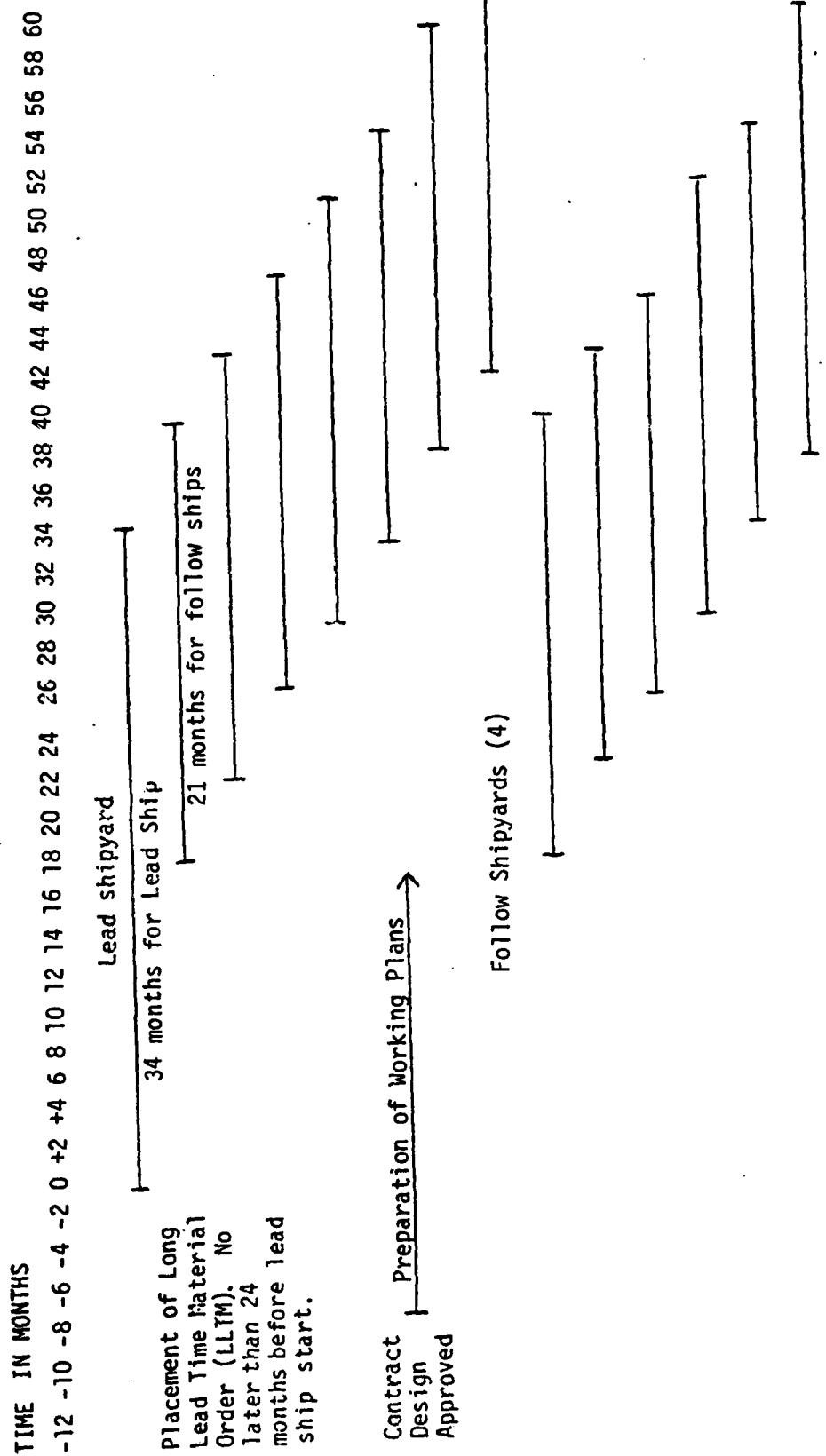
The cost of a repeat SL-7 commercial design in 1980 dollars is \$135 million. This includes the necessary berthing for a crew of approximately 200, it is emphasized this repeats the SL-7 commercial design.

To incorporate those features which traditionally always are included in military conversion of commercial ships this price would be expected to be in the area of \$200 million in 1980 dollars for each SL-7 conversion. Those features added include military communication systems, additional internal subdivision to enhance damaged stability, self defense weapons, redundant electrical power and distribution, extra fire fighting systems, and capability of at sea refueling.

According to the Maritime Administration, eight commercial United States shipyards have the necessary dock facilities and capability to construct the SL-7 which has a length of 946 feet and a beam of 105 feet and 6 inches.

Figure 1 shows a nominal schedule for construction at a high national priority. This schedule demonstrates that 32 ships could be constructed in about a five year period, provided that:

- (a) Pre-ordering of long lead material such as reduction gears, steam turbines, cranes and guns was ordered prior to start of the lead ship construction.
- (b) Work load of the affected five shipyards could be integrated to make their facilities and corporate commitment available to this program.
- (c) Modifications to the basic SL-7 design are minimized to ensure maximum applicability of the original design.
- (d) Development of the SL-7 contract design is complete and available for review well prior to award of the lead ship detail design and shipbuilding contract.
- (e) The SL-7 design used reflects consultation with all projected participating shipyards to produce a design which has a minimum of design bias. That is to say, the design is oriented to the less capable shipyards (less capable weight handling equipment, etc.).
- (f) A high degree of standardization is maintained in the ship at all the building yards. Major components must be identical with this standardization continuing down to the component level if possible. Otherwise, working plan problems will arise in modifying the lead ship design.



NOMINAL CONSTRUCTION SCHEDULE FOR SL-7 PRODUCTION OF 32 SHIPS

FIGURE 1

This will produce 32 ships in about five years. For a production run of 24 ships, no significant variation is anticipated since the eight existing SL-7's will require conversion in any case. The construction schedule as laid out provides more construction time per ship than was required during construction of the existing SL-7's.

2. Question: What is the crane capability for lifting 150 ton 8' x 8' x 80' containers from the main deck level (either permanent installation or portable Cranes on Deck (COD))?

The current SL-7 commercial design does not include this feature. Figure (2) shows the deck coverage available for five installed 150 ton capacity cranes which are commercially available. This feasible arrangement covers the deck and gives the maximum number of 8' x 8' x 80 containers to be off loaded. The cost of each crane is \$1.3 million in 1980 dollars. These cranes are fixed with structure extending into the basic structure. However, they can be removed. The use of cranes on deck is not considered a viable alternative in view of the lift requirement of 150 tons. Use of a crane configuration such as Figure (2) allows crane placement of the container over the side in a controlled manner. This allows sufficient time for a counter flooding system to control excessive roll during the container implantment.

3. Question: Could additional propulsion capacity be able to increase speed over current SL-7 capability?

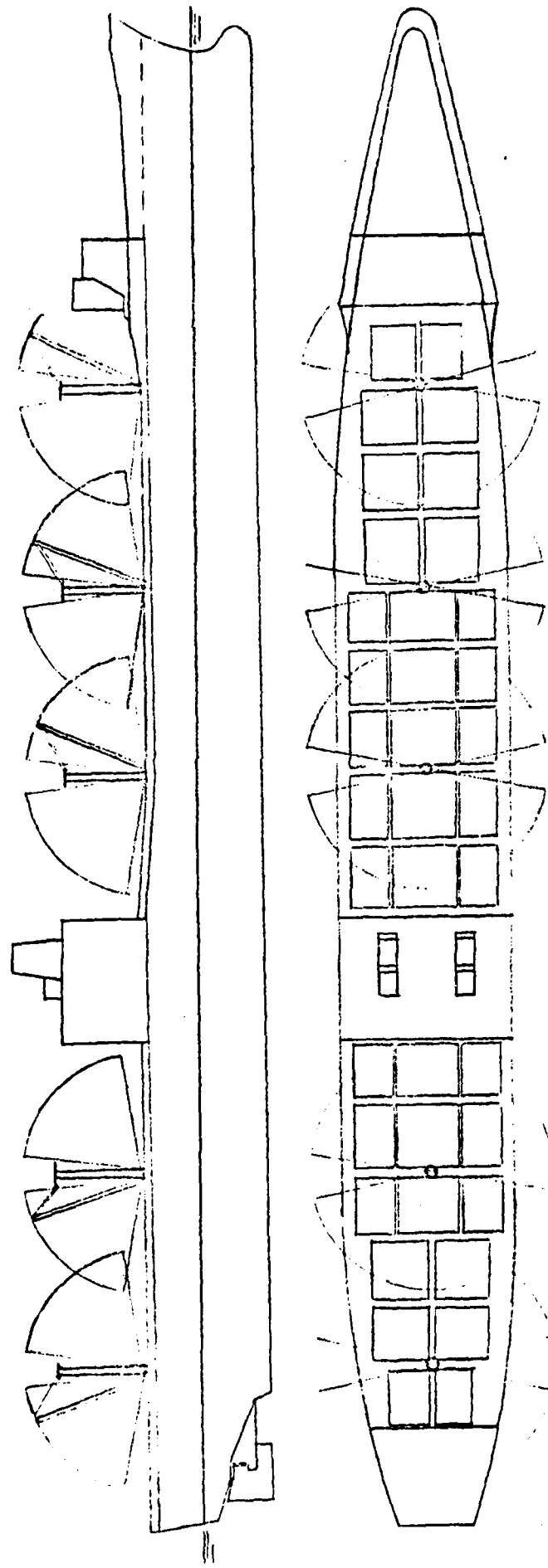
The currently installed SL-7 geared turbine steam plant is capable of 33 knots at a draft of 34 feet, and probably higher at the design draft of 30 feet. As Figure 3 shows, the fuel cost is significantly increased as the propulsion capacity is increased.

Any significant increase in installed SHP would cause a redesign of structure and produce only marginal increases in speed.

4. Question: Would there be extra cost for provision for additional fuel and berthing for up to 220 persons.

Yes, and provisions for the 220 man crew are included in question number 1.

As for fuel, if an operating scenario of 60 days underway is assumed with 56 days at 12 knots loiter speed, and 4 days at high speed of 33 knots, the fuel cost for 60 days at 1980 fuel costs is approximately \$782,000. Note that the fuel consumed in 4 days at 33 knots exceeds that consumed in 56 days at 12 knots. Referring to Figure 3 will show this speed-fuel consumption relationship. To provide sufficient fuel for this scenario, 1600 tons of additional fuel capacity beyond the 4434 ton capacity of the original SL-7 must be provided. The operating speed profile will produce a range of about 19,000 nautical miles. Cost of providing the necessary 1600 tons of fuel to support this scenario would be in the conversion of existing ballast tanks to fuel and clean ballast, and is included in the conversion costs of question number 1.



SL-7 CONTAINER SHIP WITH 5
150 LTON CAPACITY CRANES

Figure 2

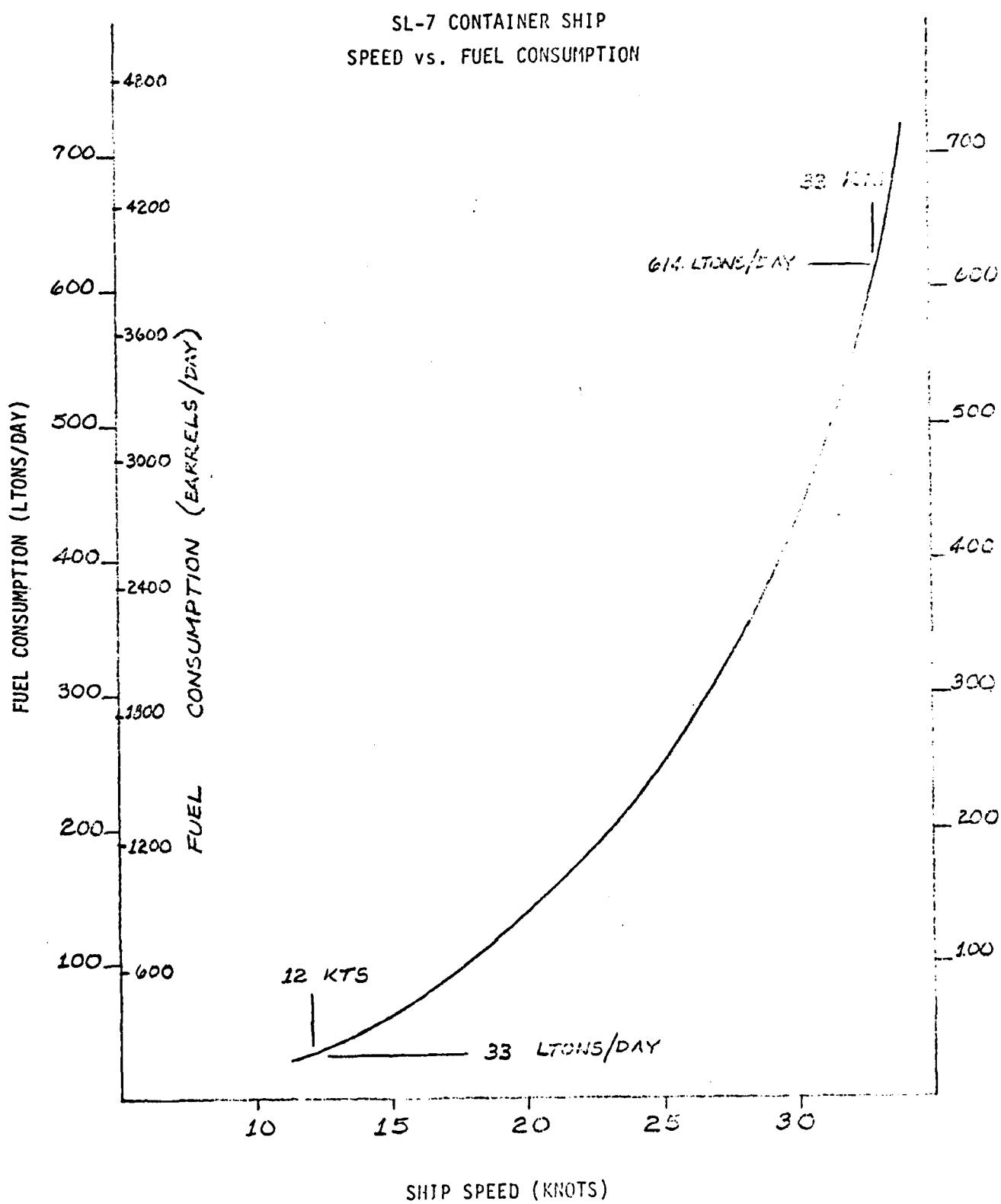


Figure 3

5. Question: What would be the cost for installation for two 76mm OTO MELARA automatic deck guns, 1 forward and 1 aft?

The MK 75, 76mm, OTO MELARA gun is presently manufactured in the United States under Italian License by the Northern Ordnance Division of FMC Corporation. They report that for a buy of 64 mounts, the lead time from contract award to delivery of the first unit is two years, with a delivery rate of 15 per year. Thus, with a contract award 1 year before start of the lead ship (at -12 months) the production run would support all 32 ships.

The cost of each mount in 1980 dollars is \$2.3 million per mount, or \$4.6 million per ship. Installation and initial support costs are estimated at an additional \$2 million per ship provided the design is modified to accept the mounts before completion of the contract design.

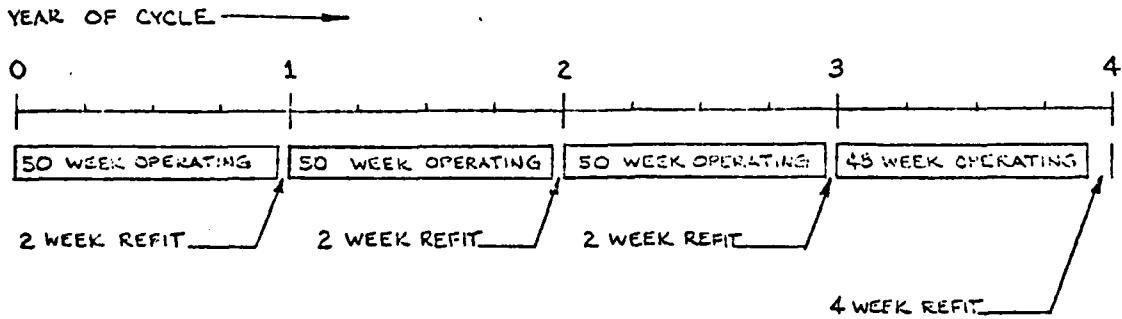
6. Question: What is the estimated yearly operation cost less personnel of the SL-7 ships?

Summarizing the information above, the annual fuel cost using the scenario described in the response to question number four, amounts to about \$4.7 million per ship. Added consumables, maintenance and refit costs would be approximately \$1.8 million per ship for a total yearly operating cost per ship estimated at \$6.5 million plus personnel costs.

7. Question: Estimate the frequency and duration of overhaul period and at sea time cycle.

American Bureau of Shipping (ABS) requirements are 2 to 6 weeks of overhaul every four years. Merchant practice is generally 350 days of continuous operation with the remaining two weeks for required maintenance and unexpected delays.

A typical operating cycle would be 60 days operating with 2 to 4 days turnover between crews, and a two week refit period each year. A thirty day refit period every four years would be reasonable. Removal of missiles and other unique mission support equipment would make the ship easily adaptable to merchant ship overhaul practices. Figure 4 shows this typical profile for one ship.



TYPICAL OPERATION/MAINTENANCE CYCLE

Figure 4

8. Question: What are the specifications of the SL-7 design?

| SL-7 Specifications | |
|--|--|
| Length Overall | 946' 1 $\frac{1}{2}$ " |
| Beam | 105' 6" |
| Draft - Design | 30' |
| Operating | 34' |
| Propulsion | Geared Steam Turbines |
| Shafts | 2 |
| Boilers | 2 |
| Shaft Horespower (total) | 120,000 |
| Depth at Main Deck (fwd of aft deck house) | 64' |
| Depth at Main Deck (aft deck house to fantail) | 68' 6" |
| Speed (light draft) | 33 + KTS |
| Displacement - 30' draft | 43,000 tons |
| 34' draft | 50,300 tons |
| Fuel Capacity | 4,434 tons |
| Fuel Consumption - 33 KTS | 614 tons/day |
| 25 KTS | 240 tons/day |
| 19 KTS | 159 tons/day |
| 12 KTS | 34 tons/day |
| Electrical Capacity | 2 installed, 3000 KW Ships Service Turbo Generator 1 installed, 1500 KW Ships Service Diesel Generator 1 installed, 60 KW Emergency Diesel Generator |
| Crew Size | 70 |

For comparison purposes, Figure (5) shows typical containerships. This figure clearly shows that from the standpoint of speed capability, the SL-7 is unique among other current containships.

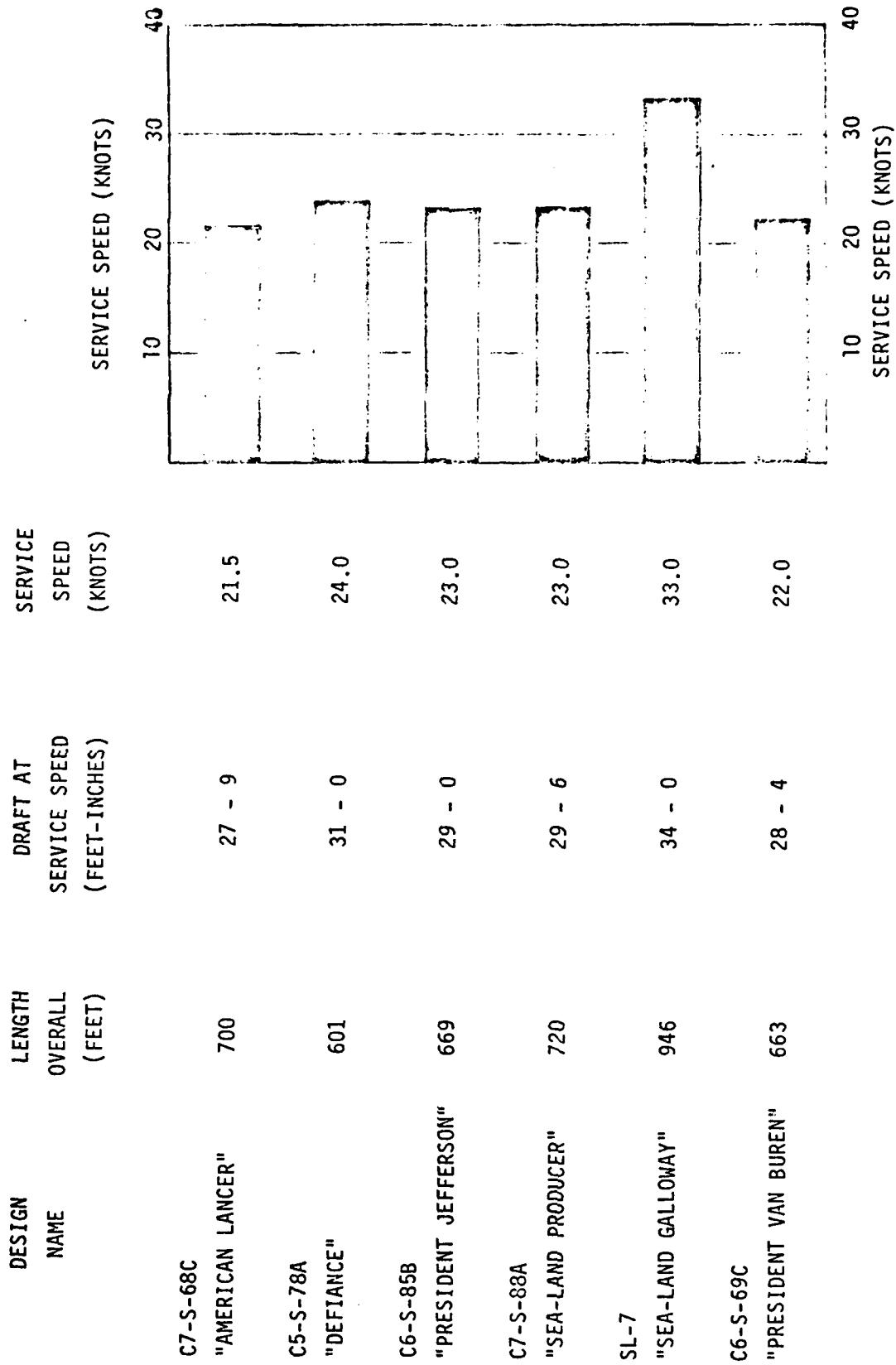
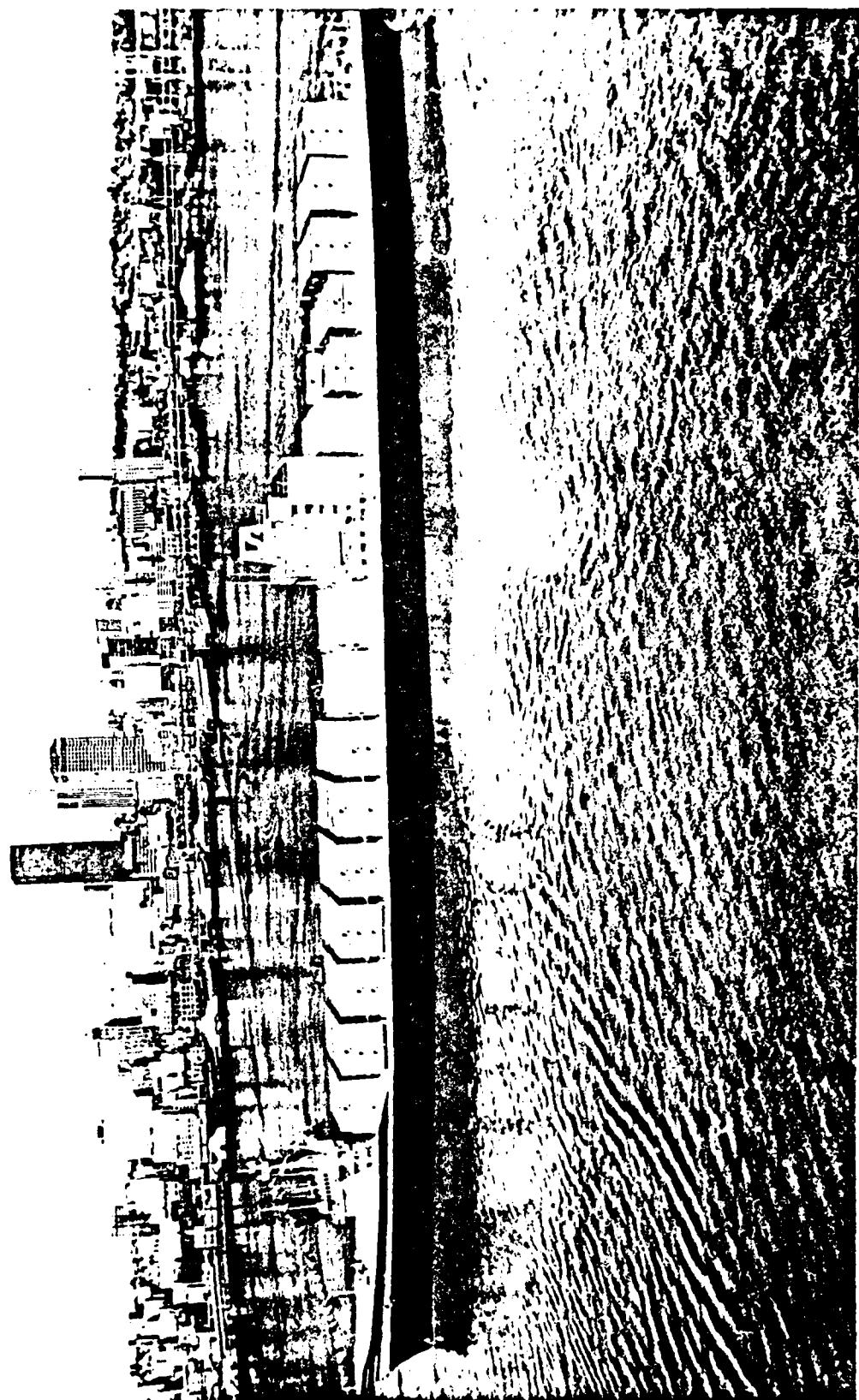
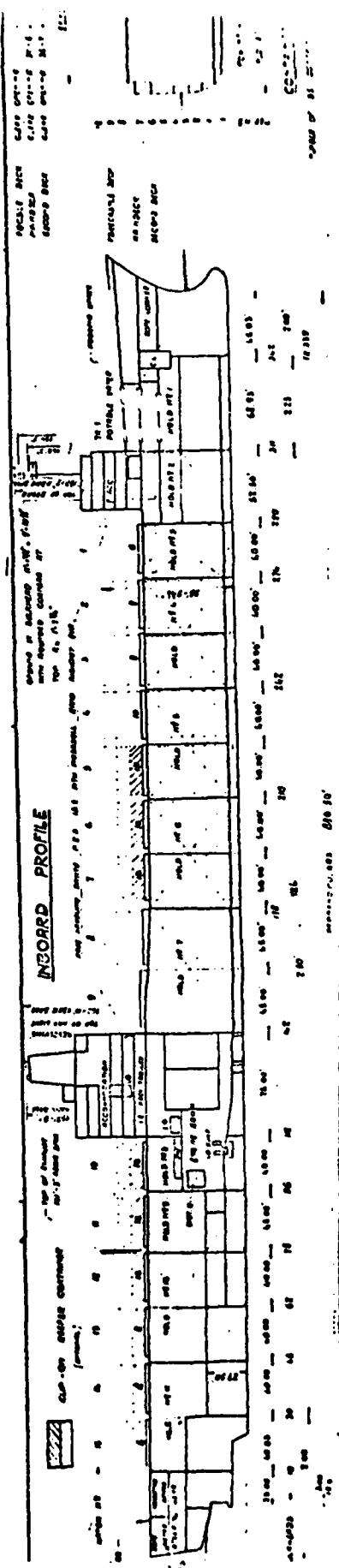


Figure 5





5-7

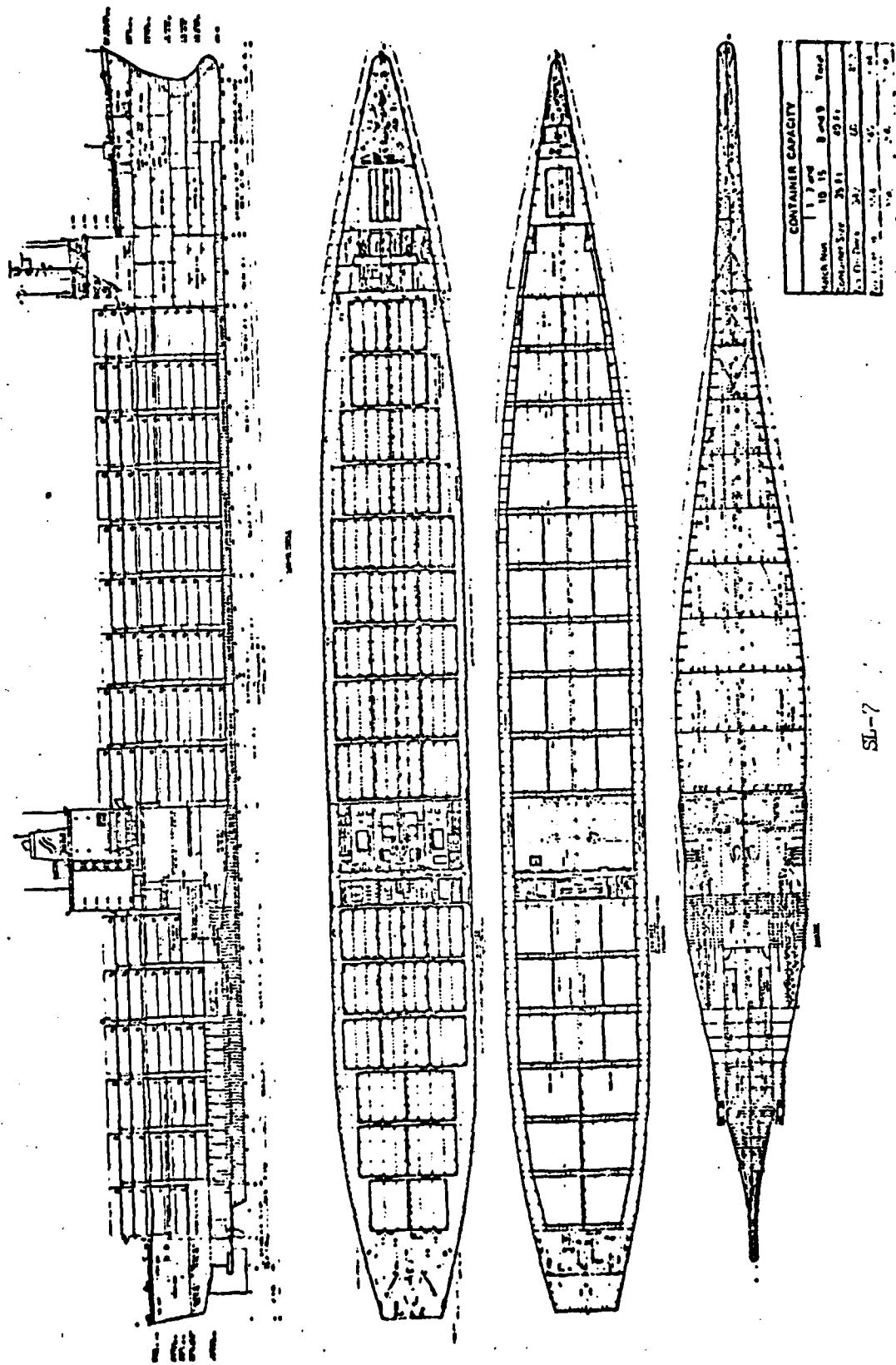


Fig. 11 General arrangement

SL-7

STUETKENMAST® – Pendulum Types

Double Pendulum Type

This is the heavy-duty type and it covers the range from 150 t SWL up to the highest loads required. It is characterized by the cargo tackle split into two parts, one on each side of the derrick head. One part of the cargo tackle can be fastened to the derrick, which effects the hook speed to increase correspondingly to the reduction of the load. For the swing-through manoeuvre the connecting traverse of the lower cargo blocks has to be disconnected and both parts of the cargo tackle swing through. The whole manoeuvre takes about 8 minutes or less depending on the SWL.

Split Purchase Type

The Split Purchase Type is intended for capacities between 60 and 150 t SWL. It also allows increased hook speeds with one part of the cargo tackle fastened to the derrick.

The swing-through manoeuvre is easier and faster, because it can be done without disconnecting the connecting traverse of the lower cargo blocks. Both Pendulum Types are driven by two cargo winches and two span winches, all of equal pull on the drum. The second cargo winch effects high speeds on the hook. In cases where high hook speeds are not required, only one cargo winch may be installed without any change to the operation of the Stuettken-Mast.

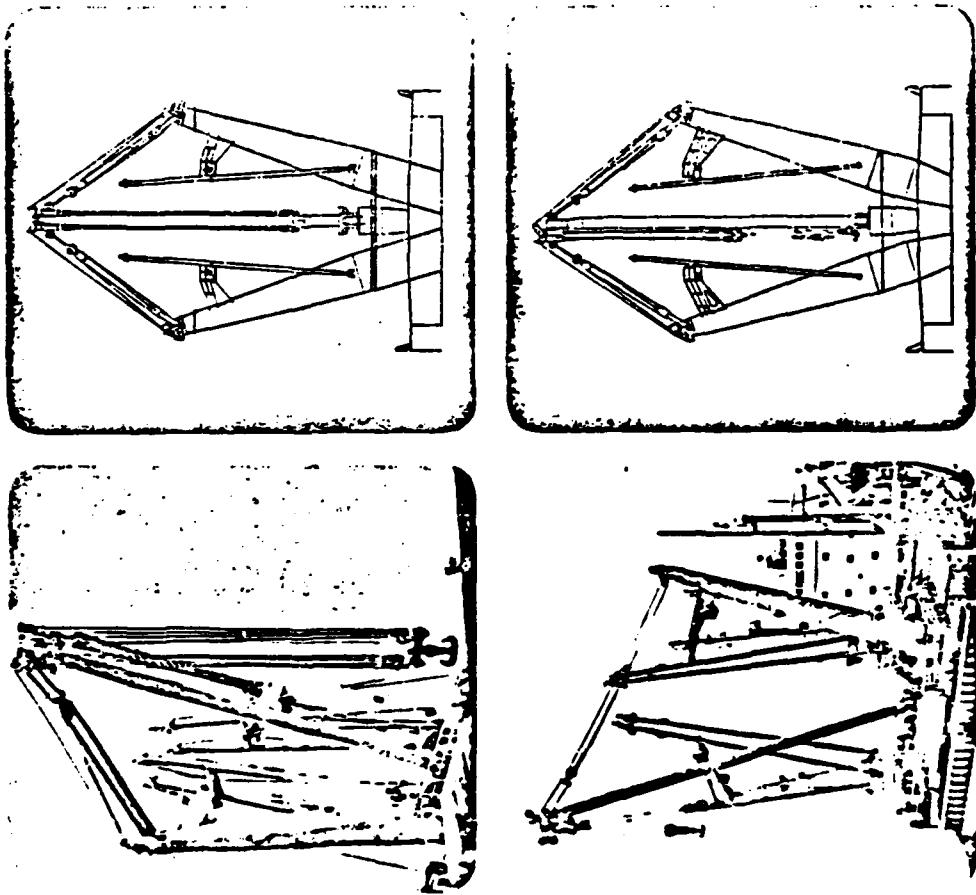


TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Delta Steamship Lines | Waterman Steamship Corp. | Central Gulf Steamship Corp. |
|------|---|---|---|---------------------------------------|---|--|
| 1 | MARAD Design | C8-5-81b | C8-5-81b | C9-5-81d | C9-5-81d | C9-5-81d |
| 2 | Hull Numbers (MARAD) | 228 229 230 236 237 | 231 232 233 234 235 238 | 259 260 261 | 262 263 264 | 265 274 275 |
| 3 | Ship Names | LASH ITALIA LASH TURKIYE LASH ESPANA LASH ATLANTICO LASH PACIFICO | THOMAS E. CUFFE GOLDEN BEAR PACIFIC BEAR JAPAN BEAR CHINA BEAR PHILLIPINE BEAR | DELTA MAR DELTA NORTE DELTA SUD | ROBERT E. LEE STONEWALL JACKSON SAM HOUSTON | GREEN VALLEY GREEN HARBOR GREEN ISLAND |
| 4 | Length overall including overhang | 820'-0" | 820'-0" | 893'-4" | 893'-4" | 893'-4" |
| 5 | Length overall excluding crane overhang | 772'-0" | 772'-0" | 845'-4" | 845'-4" | 845'-4" |
| 6 | Length between perpendiculars | 724'-0" | 724'-0" | 797'-4" | 797'-4" | 797'-4" |
| 7 | Molded Breadth (Beam) | 100'-0" | 100'-0" | 100'-0" | 100'-0" | 100'-0" |
| 8 | Depth (Molded) at the side | 60'-0" | 60'-0" | 60'-0" | 60'-0" | 60'-0" |
| 9 | Shaft Horsepower (ABS Max.) | 32,000 | 32,000 | 32,000 | 32,000 | 32,000 |
| 10 | Speed, Normal @ 28' W.L. | 22.5 Knots | 22.5 Knots | 22 Knots | 22 Knots | 22 Knots |
| 11 | Draft, Design | 28'-0" | 28'-0" | 28'-0" | 28'-0" | 28'-0" |
| 12 | Deadweight Tonnage @ 28' W.L. | 17,990 L.T. | 17,904 L.T. | 21,552 L.T. | 21,901 L.T. | 21,901 L.T. |
| 13 | Full Load Draft | 35'-1-1/4" | 35'-1-3/16" | 38'-1-1/2" | 38'-1-1/2" | 38'-1-1/2" |
| 14 | Deadweight Tonnage @ Full Load Draft | 29,820 L.T. | 29,749 L.T. | 40,592 L.T. | 40,679 L.T. | 46,153 L.T. |
| 15 | U. S. Gross Tonnage | 26,406 | 26,456 | 32,269 | 32,269 | 32,269 |
| 16 | U. S. Net Tonnage | 18,706 | 18,706 | 24,767 | 24,767 | 24,767 |
| 17 | Displacement (Design) | 32,761 L.T. | 32,700 L.T. | 38,062 L.T. | 38,062 L.T. | 38,062 L.T. |
| 18 | Displacement Maximum Draft | 44,606 L.T. | 44,606 L.T. | 57,082 L.T. | 57,082 L.T. | 56,451 L.T. |
| 19 | Light Ship Displacement | 14,786 L.T. | 14,857 L.T. | 16,510 L.T. | 16,162 L.T. | 16,161 L.T. |

TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS (Continued)

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Delta Steamship Lines | Waterman Steamship Corp. | Central Gulf Steamship Corp. |
|------|---|---------------------------|--------------------------|--------------------------|-----------------------------|---------------------------------|
| 20 | Length on 28'-0" Waterline | 740'-0" | 740'-0" | 813'-4" | 813'-4" | 813'-4" |
| 21 | Length & Scantling Draft | | | 815'-2" | 815'-2" | 815'-2" |
| 22 | Scantling Length | 35'-0" | 35'-0" | 790'-8-9/16" | 790'-8-9/16" | 790'-8-9/16" |
| 23 | Scantling Draft | 35'-0" | 35'-0" | 38'-0" | 38'-0" | 38'-0" |
| 24 | Depth @ Main Deck Molded - Centerline | 61'-0" | 61'-0" | 61'-0" | 61'-0" | 61'-0" |
| 25 | Light Ship Draft | 15'-3-1/8" | 15'-3-5/8" | 14'-6-1/4" | 14'-3-3/8" | 14'-3-3/8" |
| 26 | Length Overall including crane overhang | 820'-0" | 820'-0" | 893'-4" | 893'-4" | 893'-4" |
| 27 | Speed - Maximum Draft | 19.1 Knots | 19.1 Knots | 19.1 Knots | 19.1 Knots | 19.1 Knots |
| 28 | Accommodations | 40 | 45 | 45 | 38 | 35 |
| 29 | Lifeboats - Diesel | (1) 50 Persons | (1) 50 Persons | (1) 48 Persons | (1) 45 Persons | (1) 35 Persons |
| 30 | Lifeboats - Hand Powered | (1) 50 Persons | (1) 50 Persons | (1) 48 Persons | (1) 45 Persons | (1) 35 Persons |
| 31 | Davits - Gravity Type | 2 | 2 | 2 | 2 | 2 |
| 32 | Fuel | 5,344 L.T. | 5,344 L.T. | 5,740 L.T. | 5,740 L.T. | 5,740 L.T. |
| 33 | Liquid Cargo | 1,164 L.T. | 1,164 L.T. | None | None | None |
| 34 | Cargo and Ballast Tanks | | | 389,093 cu.ft. | 389,093 cu.ft. | 389,093 cu.ft. |
| 35 | Diesel Oil | 112.72 L.T. | 112.72 L.T. | 114.04 L.T. | 112.7 L.T. | 112.7 L.T. |
| 36 | Lube Oil | 67.65 L.T. | 76.86 L.T. | 85.73 L.T. | 76.5 L.T. | 76.5 L.T. |
| 37 | Salt Water Ballast | 16,063 L.T. | 16,063 L.T. | 10,174 L.T. | 8,808 L.T. | 8,808 L.T. |
| 38 | Passive Stabilizer Tanks | 1,679.45 L.T. | 1,679.45 L.T. | 1,682.58 L.T. | 1,682.6 L.T. | 1,682.6 L.T. |
| 39 | Fresh Water Tanks | 792.58 L.T. | 792.58 L.T. | 853.18 L.T. | 853.18 L.T. | 853.18 L.T. |
| 40 | Main Propulsion | Steam | Steam | Steam | Steam | Steam |
| 41 | Endurance (Nautical Miles) | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 |
| 42 | Number of Propellers | One | One | One | One | One |
| 43 | Evaporator Capacity - Gallons/Day | 25,000 | 25,000 | 25,000 | 25,000 | 25,000 |

TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS (Continued)

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Bell Steamship Lines | Waterman Steamship Corp. | Central Gulf Steamship Corp. |
|------|---|--|--------------------------|-------------------------|-----------------------------|---------------------------------|
| 44 | Steering Gear - Elect. "jd. (2) 75 H.P. Motors | Sperry Rand | Sperry Rand | Avondale | Avondale | Avondale |
| 45 | Refrigeration - Containerized | 3 Tons | 3 Tons | 3 Tons | 3 Tons | 3 Tons |
| 46 | Air Conditioning | (2) 40 Ton Units | (2) 40 Ton Units | (2) 45 Ton Units | (2) 45 Ton Units | (2) 45 Ton Units |
| 47 | Generator Capacity - Ships Service T.G. | 2,500 KW | 2,500 KW | 2,000 KW | 2,000 KW | 2,000 KW |
| 48 | Generator Capacity - Aux. Diesel | 2,000 KW | 2,000 KW | 2,000 KW | 2,000 KW | 2,000 KW |
| 49 | Generator Capacity - Emerg. Diesel | 250 KW | 250 KW | 250 KW | 250 KW | 250 KW |
| 50 | Generator Load Analysis | | | | | |
| | Maximum Sea Load | 2,201 KW | 2,214 KW | 1,850 KW | 1,820 KW | 1,820 KW |
| | Maximum Port Load | 1,600 KW | 3,020 KW | 1,206 KW | 2,326 KW | 2,326 KW |
| | Deck Machinery Included (Sea) | 40 KW | 55 KW | 40 KW | 40 KW | 40 KW |
| 51 | Emergency Generator Load Analysis | | | | | |
| | Maximum Sea Load | 246 KW | 242 KW | 242 KW | 242 KW | 242 KW |
| | Maximum Port Load | 134 KW | 134 KW | 138 KW | 138 KW | 138 KW |
| 52 | Number of Cargo Holds | 6 | 6 | 7 | 7 | 7 |
| 53 | Cargo holds arranged to carry lighters only, access in wing walls, using wing tanks for grain or ballast. | Containers Fwd. | Containers Fwd. | Containers Fwd. | Lighters Only | Lighters Only |
| 54 | Barge Size - Length | 61'-6" | 61'-6" | 61'-6" | 61'-6" | 61'-6" |
| | Barge Size - Width | 31'-2" | 31'-2" | 31'-2" | 31'-2" | 31'-2" |
| | Barge Size - Height | 13'-0" | 13'-0" | 13'-0" | 13'-0" | 13'-0" |
| 55 | Barge Weight | 80 L.T. | 80 L.T. | 80 L.T. | 80 L.T. | 80 L.T. |
| 56 | Dry Cargo - No. of Lighters | 49 | 49 | 55 | 89 | 89 |
| | Grain Capacity | | | | | |
| | Below Deck | 712,800 cu.ft. | 1,023,100 cu.ft. | ,065,300 cu.ft. | 1,065,300 cu.ft. | |
| | On Main Deck at Centerline | 39,600 cu.ft. | 80,400 cu.ft. | 80,400 cu.ft. | 80,400 cu.ft. | |
| | On Hatch Covers | 217,800 cu.ft. | 217,800 cu.ft. | 603,000 cu.ft. | 643,200 cu.ft. | |
| | Bale Capacity | | | | | |
| | Below Deck | 702,000 cu.ft. | 999,600 cu.ft. | 1,038,800 cu.ft. | 1,038,800 cu.ft. | |
| | On Main Deck at Centerline | 39,000 cu.ft. | 78,400 cu.ft. | 78,400 cu.ft. | 78,400 cu.ft. | |
| | On Hatch Covers | 214,500 cu.ft. | 588,000 cu.ft. | 627,200 cu.ft. | 627,200 cu.ft. | |
| | NOTE: | Second tier of lighters restricted to a maximum of 380 L.T. due to stowage of container 11ft. frame above hatch. | | | | |

TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS (Continued)

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Delta Steamship Lines | Watertman Steamship Corp. | Central Gulf Steamship Corp. |
|------|--|---------------------------|--------------------------|--------------------------|------------------------------|---------------------------------|
| 57 | Alternate Lighters | 12 | 12 | None | None | None |
| | Grain Capacity | 237,600 cu. ft. | 237,600 cu. ft. | None | None | None |
| | Bale Capacity | 234,000 cu. ft. | 234,000 cu. ft. | None | None | None |
| 58 | Containers | 250 | 334 | 144 | None | None |
| | Bale Capacity | 350,700 cu. ft. | 350,700 cu. ft. | 151,200 cu. ft. | None | None |
| 59 | Alternate Number of Containers | 720 | 720 | None | None | None |
| | Bale Capacity | 757,000 cu. ft. | 757,000 cu. ft. | None | None | None |
| 60 | Lighter Gantry Crane (Capacity) | 500 S.T. | 500 S.T. | 510 S.T. | 500 S.T. | 510 S.T. |
| 61 | Lighter Gantry Crane (Builder) | Alliance | Alliance | Morgan | Alliance | Morgan |
| 62 | Container Gantry Crane (Builder) | Paceco | Paceco | Skagit | None | None |
| 63 | Capacity of Container Crane | 30 L.T. | 30 L.T. | 30 L.T. | None | None |
| 64 | Maximum Lift Position of Lighter Gantry Crane | 96'-0" A.B.L. | 96'-0" A.B.L. | 96'-0" A.B.L. | Yes | Yes |
| 65 | 30 Ton Container Crane secured over Hatch #1 - Frames 52 - 58. Outsize cargo cannot be carried forward of Frame 60 | Yes | Yes | Yes | No Container Crane | No Container Crane |
| 66 | Lighter Handling - Portable LCM Guide Rails | No | No | Yes | Yes | Yes |
| 67 | Tiedown to suit 500 Ton Gantry | Suitable | Suitable | Suitable | Suitable | Suitable |
| 68 | Constant Tension Mooring Winches | (8) @ 150,000# | (4) @ 150,000# | (4) @ 150,000# | (4) @ 150,000# | (4) @ 150,000# |
| 69 | Barge Handling Winches - Stern Well | 2 | 2 | 2 | 2 | 2 |
| 70 | Retrieving Winches Aft - Stern Well | 2 | 2 | 2 | 2 | 2 |
| 71 | Mooring Winches Aft - Stern Well | 2 | 2 | 2 | 2 | 2 |
| 72 | LASH Gantry Crane - Manufacturer | Alliance | Morgan | Alliance | Alliance | Morgan |
| | Gantry Motors | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. |
| | Hoist Motors | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. | (4) @ 150 H.P. |
| 73 | Lighter load frame tie down arrangement | (for Morgan Crane) | (for Morgan Crane) | (for Morgan Crane) | (for Morgan Crane) | (for Morgan Crane) |
| 74 | Light Weight Snug Straining Anchors | (2) @ 22,470 lbs. | (2) @ 22,470 lbs. | (2) @ 22,470 lbs. | (2) @ 22,470 lbs. | (2) @ 22,470 lbs. |
| 75 | Spare Anchor | (1) @ 19,110 lbs. | (1) @ 19,110 lbs. | (1) @ 19,110 lbs. | (1) @ 19,110 lbs. | (1) @ 19,110 lbs. |

TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS (Continued)

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Delta Steamship Lines | Waterman Steamship Corp. | Central Gulf Steamship Corp. |
|------|---|---------------------------|--------------------------|--------------------------|-----------------------------|---------------------------------|
| 86 | General Arrangement Main Deck - Fitted with tension mooring winches, stowage lockers and gantry tie downs on wing walls - No interference | Yes | | Yes | Yes | Yes |
| 87 | Maximum S. W. Bending Moment | 377,669 ft. tons | 377,669 ft. tons | 538,555 ft. tons | 538,555 ft. tons | 538,555 ft. tons |
| 88 | Deck Plating and Framing Aft - Adequate for outsize cargo deck loading. | Yes | Yes | Yes | Yes | Yes |
| 89 | Firemain Stations on Main Deck Wing Walls Aft of Frame 52 - No Interference. | Yes | Yes | Yes | Yes | Yes |
| 90 | Miscellaneous Longitudinal Bulkheads Aft | Suitable | Suitable | Suitable | Suitable | Suitable |
| 91 | W. T. Longitudinal Bulkheads - 35' and 40' off Centerline Aft - Adequate for outsize deck cargo. | Yes | Yes | Yes | Yes | Yes |
| 92 | I. B. Plating in way of holds is designed for the carriage of lighters. | Yes | Yes | Yes | Yes | Yes |
| 93 | Top plating in the way of Hold #1 stiffened for the carriage of containers. | Yes | Yes | Yes | No | No |
| 94 | Fire Stations on Wing Walls - No Interference. | Yes | Yes | Yes | Yes | Yes |
| 95 | Location of Exhaust Fans on Wing Walls - No Interference. | 10 | 10 | 10 | 10 | 6 |
| 96 | Plumbing and Deck Drains - No Interference | Suitable | Suitable | Suitable | Suitable | Suitable |
| 97 | Intake Fans on Wing Walls - No Interference | 2 | 2 | 2 | 2 | 2 |
| 98 | Craneway Extension Aft | 48'-0" | 48'-0" | 48'-0" | 48'-0" | 48'-0" |
| 99 | Fire Control Plan - No Interference | Suitable | Suitable | Suitable | Suitable | Suitable |

TABLE 2.1 PRINCIPAL CHARACTERISTICS OF U. S. FLAG LASH SHIPS (Continued)

| Item | Characteristic | Prudential Grace Lines | Pacific Far East Line | Delta Steamship Lines | Waterman Steamship Corp. | Central Gulf Steamship Corp. |
|------|--|---------------------------|--------------------------|--------------------------|-----------------------------|---------------------------------|
| 100 | Access in Box Girders - No Interference | Suitable | Suitable | Suitable | Suitable | Suitable |
| 101 | Access and Stowages in Wing Walls - No Interference | Suitable | Suitable | Suitable | Suitable | Suitable |
| 102 | 32' and 40' Levels, Hatches #1 and #2 fitted with Container Guides | Yes | | | | |
| 103 | When containers are carried seven high, the load imposed on the lowest container in the tier shall not exceed 100 L. T. | Yes | | | | |
| 104 | When lighters or containers, or both, are carried on hatch covers, the hatch cover load shall not exceed 527 L. T. for lighters or 721 L. T. for containers. | Yes | | | | |
| 105 | Alternate stowage of containers and lighters require major changes in guide structure. | Yes | | | | |
| 106 | The container crane would have to be removed to stow lighters at Hold 1a. | Yes | | | | |
| 107 | Maximum lift operating position of container gantry crane. | 93'-0" A.B.L. | 93'-0" A.B.L. | 93'-0" A.B.L. | 93'-0" A.B.L. | 93'-0" A.B.L. |
| 108 | When containers are required to be stowed seven high and weigh more than 15 tons, the 7th container tier must be carried empty. If the first (6) tiers weigh less than 15 tons each, the balance or part of the balance of the load to make up may be carried in the 7th tier of containers. | Yes | | | | |
| 109 | A total of 62 lighters may be carried if stowed two high on the main deck and hold and hatch covers, but the upper lighter must be empty if the lower lighter is full. Lower Lighter - 410 S.T. Upper Lighter - Empty Lower Lighter - 273.33 S.T. Upper Lighter - 136.67 S.T. | Yes | | | | |

APPENDIX B

Information Furnished by:
ROHR MARINE, INC.

